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Damsels in Distress: A Preliminary Assessment of Pomacentridae Extinction Risk

Allison Roberts
Old Dominion University

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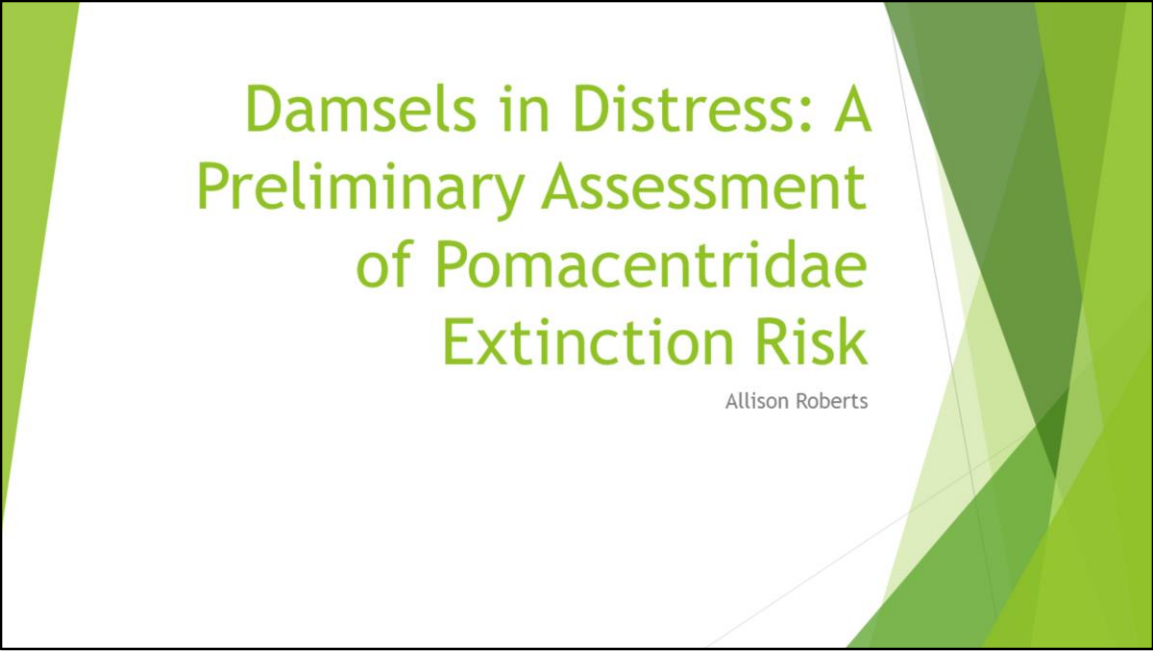


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Damsels in Distress: A Preliminary Assessment of Pomacentridae Extinction Risk

Allison Roberts

Hello, I'm Allison. I've been working with Dr. Ralph over at the Global Marine Species Assessment since 2015. Recently I've been working with Pomacentridae, and today I will be reviewing an assessment of their extinction risk.

Outline presentation

- ▶ Introduction
 - ▶ IUCN Background
 - ▶ About Pomacentridae
 - ▶ Why Damselfish?
- ▶ IUCN Methods
- ▶ Results
- ▶ Discussion
- ▶ Q&A



Plectroglyphidodon dickii

First, I will introduce the organization behind the research. Then I will talk a little bit about Pomacentridae, and why they're being assessed. I will share with you the IUCN Methods of assessment, go over the current results, and finally discuss the implications.



Amblyglyphidodon ternatensis

Introduction

What is the IUCN?

- International Union for Conservation of Nature
- Founded in 1948
- Worlds largest global environmental organization
 - Conservation of biodiversity
- IUCN Red List of Threatened Species
 - IUCN Red List Categories and Criteria



- What is the IUCN? The International Union for Conservation of Nature was founded in 1948.
- It has become the largest environmental organization in the world, and its focus is on protecting the biodiversity of the earth's species.
- The IUCN has a publicly accessible database of all known organisms, called the Red List of Threatened Species. For a species to make it onto the Red List, it must undergo extensive assessment for risk of extinction, using the IUCN Red List Categories and Criteria as a standard guide.

What is the MBU?



GLOBAL MARINE SPECIES ASSESSMENT



- Marine Biodiversity Unit
 - Formed in 2005
 - To assess 20,000 marine species for the Red List
 - In charge of the Global Marine Species Assessment (GMSA)
- Assessing the extinction risk of myriad species found throughout marine environments
- Unique challenges to assessing oceanic species
 - Very few have actually been assessed (4.4% of known species)
 - 14% of species on the Red List are marine species

- The majority of species currently on the Red List are terrestrial, which is where the Marine Biodiversity Unit comes in.
- The MBU was formed in 2005, and is in charge of the Global Marine Species Assessment project, based here at ODU. The goal of MBU, with the support of GMSA and other similar projects, is to assess 20,000 species for the Red List.
 - These will include vertebrates, habitat forming primary producers (such as seagrasses, mangroves, kelps and so on), reef building corals, and priority invertebrates.
- There are unique challenges to assessing oceanic species compared to those found on land.
 - For example, the fish in a given area will all look the same, making it nearly impossible to count them, and tagging is impractical.
- As a result, only 4.4% of known marine species have been assessed, and only 14% of species currently on the Red List are marine organisms.

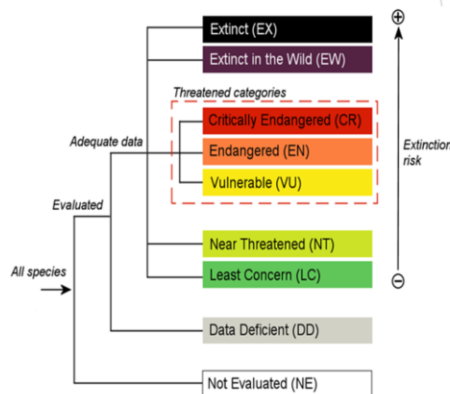
IUCN Classifications and Criteria

Extinction Criteria

- Extinction occurs when mortality rates are greater than birth rates, and populations decline over time

Criteria	Description
A	Population has declined, is declining, or will decline over the three most current generations
B	Small range AND two of the three sub-criteria related to (i) fragmentation, small number of threat-based locations, (ii) continuing declines in range or mature individuals, and (iii) extreme fluctuations
C	Small number of mature individuals and the population has experienced, is experiencing, or will experience a continuing decline
D	The number of mature individuals is very small or the range is very small
E	Quantitative population analysis indicates that the probability of extinction in the wild is high

IUCN Classifications



- So what are the IUCN Classifications and Criteria for the Red List?
- First, they are based on extinction theory.
 - In a nutshell, this theory says that extinction occurs when mortality rates within a population are greater than birth rates over an extended period of time, causing populations to decline.
- The IUCN has five criteria, A-E, outlined in this table.
 - To be considered threatened, the species we're looking at must exhibit symptoms of any of these criteria over an extended period of time
 - The time will vary depending on the species, but a sufficient number of generations must be observed for a trend to be seen
- The classifications that the IUCN assigns to species after assessment are outline here.
 - Species with adequate data can be assigned one of seven categories, three of which correspond to those that are threatened, the Vulnerable, Endangered, and Critically Endangered classifications.

About Pomacentridae



Chrysiptera hemicyanea

- Currently 395 known species of Pomacentridae
- Include Anemonefish and Damselfish
- Found throughout the world, mostly in tropical waters in the Indo-West Pacific
- Restricted to coral reef habitats
 - Some live among rocks and crevices
 - Most require presence of particular coral species, such as *Acropora*, in order to thrive

- A little bit about Pomacentridae:
- There are currently 395 known species in this family, which include anemonefish and damselfish.
- Pomacentridae are found all over the world, with high concentrations in the tropical waters of the Indo-West Pacific.
- They are highly restricted to coral reef habitats, some living among rocks and crevices, while most require the presence of specific coral species, such as *acropora* in order to survive.

About Pomacentridae



Neoglyphidodon oxyodon

- Most inhabit the Shallow Photoc zone
 - 0-50 meters
- Some inhabit the Deep Photoc zone
 - 51-200 meters
- Diet
 - Planktivores
 - Omnivores
 - Coralvores

- While there are some Pomacentridae species that live deeper in the water column, the majority live in the shallow photic zone, and forage near the substratum of their shallow environment.
- Diets are wide-ranging
 - some are vegetarians,
 - some are known to eat a variety of plankton, small crustaceans, and benthic worms,
 - and there are a few that exclusively eat coral.

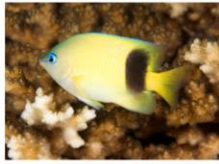
About Pomacentridae



Chromis viridis



Chrysiptera parasema



Plectroglyphidodon johnstonianus



Chrysiptera oxycephala

- 24 Species meet IUCN criteria for threatened status
- 7 have been published



Stegastus redemptus (published)

- Of the 395 Pomacentridae, there are 24 damselfish that meet the IUCN criteria for some threatened status.
- Of these 24, 7 have been published to the Red List.
- This is where interns like myself come in.
 - What I've done at GMSA is I've searched through publications to help create assessments for newly described species,
 - I've used ArcGIS to create draft maps for the new species,
 - and reviewed the remaining assessments, ensuring they follow the IUCN Red List guidelines.

Why Pomacentridae?

- Rely on coral reefs for survival
- Indicator of health of coral reef habitats
- Bleaching events



Coral bleaching

- Why are we assessing these fish?
 - Damsels are an iconic coral reef species, and they rely almost entirely on the coral structures of the reef.
 - Because of this, they can help us measure the health of the ecosystem.
 - We know that corals are undergoing bleaching events right now, and we know that these events are going to persist.
 - Can this fish adapt to the circumstances, or will it die off with the corals it relies on?

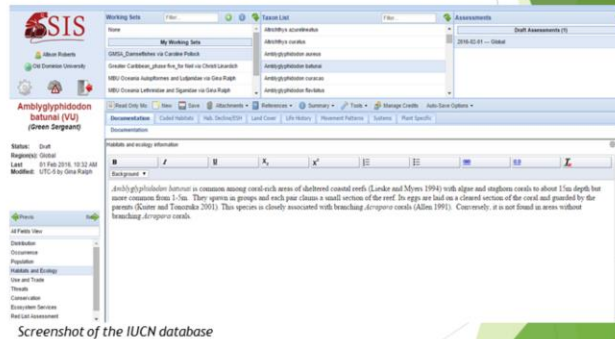


Pomacentrus moluccensis

IUCN Methods

IUCN Methods

- ▶ Species information for all 395 Pomacentridae were collected
 - ▶ Taxonomy
 - ▶ Distribution
 - ▶ Population
 - ▶ Habitat and ecology
 - ▶ Life history
 - ▶ Utilization
 - ▶ Threats
 - ▶ Conservation measures



Screenshot of the IUCN database

- The IUCN Method of assessing the Pomacentridae begins with species-specific data collection of all 395 species. (which is what interns such as myself assist in doing)
- Publications are combed through for information regarding the taxonomy, distribution, population, ecology, life history, utilization, potential threats, and conservation measures in place for each species.

IUCN Methods

- ▶ Workshop held in Fiji in 2011 involving local and international experts
- ▶ Each species assessed individually and assigned to one of eight levels of extinction risk



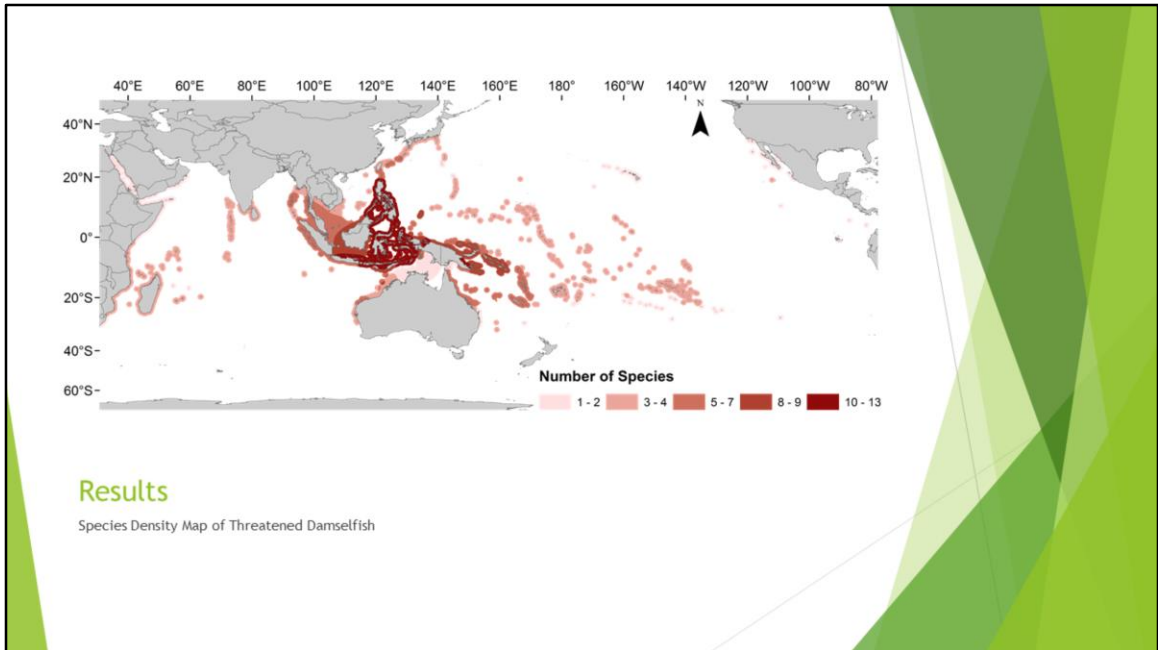
Experts in Fiji, 2011

- Once this is done, a workshop is held
 - Local and international taxonomic experts come together and pick through the data that was collected, checking for errors, making corrections, updating information, etc.
 - For Pomacentridae it was held in Fiji in 2011
- From here, the fish are assigned to one of the extinction risk levels mentioned earlier.



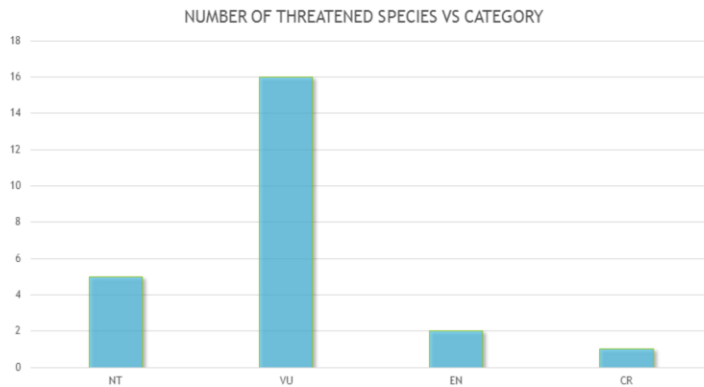
Chrysiptera springeri

Results

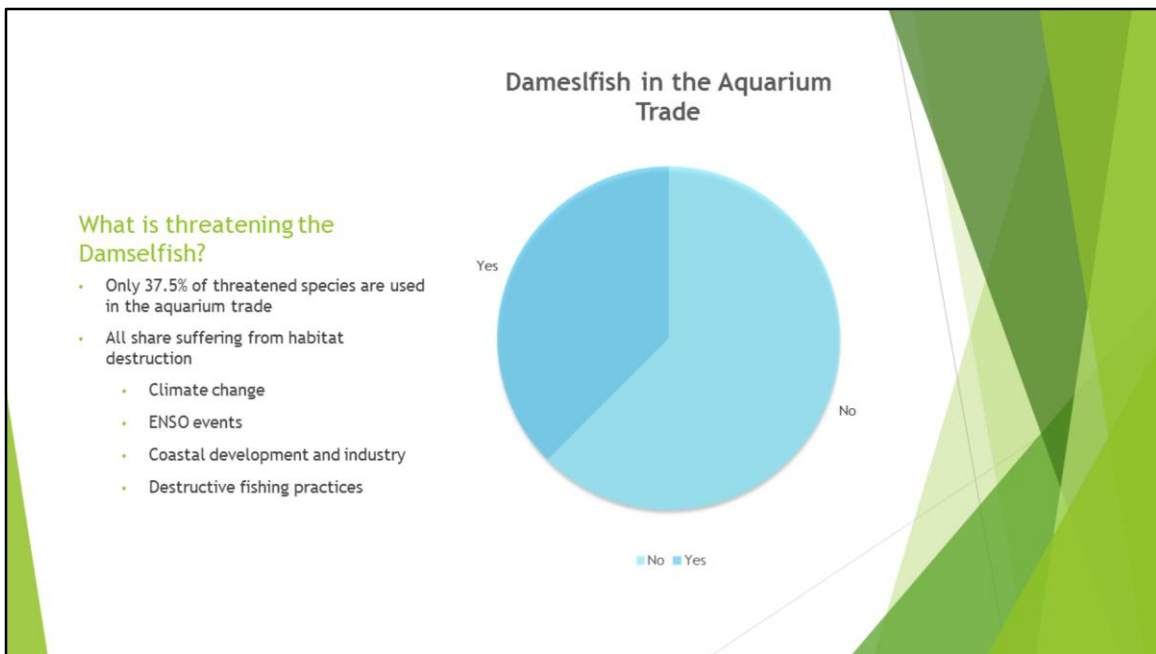


- This map shows the species density of the 24 threatened damselfish we've been discussing.
- As you can see, overall they have a wide distribution,
 - ranging from the east coast of Africa and the Red Sea, all the way across the Indo-Pacific region to the west coast of north and central America.
- They are highly concentrated in the Oceania region, especially in the Coral Triangle which includes the Philippines, Indonesia, and Papua New Guinea.

Results



- This graph is showing the number of threatened species in each category.
- As you can see, most of the threatened damsels, 16 of them, are classified as vulnerable, 5 are near threatened, 2 are endangered, and 1 is critically endangered.
- What may be causing this?



- Damselfish are an ornamental fish, many people love to have them in their aquariums, making them susceptible to the aquarium trade.
- This chart is showing that about 37% of the threatened damselfish are commonly caught for this purpose.
- This is in addition to the myriad other threats they all face, including
 - climate change,
 - el Niño events,
 - coastal development, industry,
 - and destructive fishing practices
 - cyanide fishing, dynamite fishing, ghost fishing, and so on



Amblyglyphidodon batunai

Conclusion

Conclusion

- ▶ What do the results mean?
 - ▶ Results show direct impact of human activity on damselfish communities
 - ▶ Questions left unanswered



Chrysiptera pricei

- The results show that human activity is the biggest threat to these damselfish.
- With the majority of the threatened species living around the Coral Triangle, a region sensitive to bleaching events, where destructive fishing methods are common, and where many areas are building up their coastline to support increased tourism, following the Damselfish may very well become paramount in future assessments of marine conditions.
 - The resiliency of this little fish may tell us what is to come of the diversity of our planet's oceans
- Being that this is only a preliminary assessment of the Pomacentridae, questions still remain:
 - How far-reaching an impact do our destructive tendencies already have on these fish?
 - How far can they be pushed to the edge?
 - Do they have the capacity to recover?

Thank you!



Cheiloprion labiatus

A special thanks to Dr. Ralph and Dr. Carpenter!

Thank you for listening!

Questions?